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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/620,995	07/16/2003	Jung-Hun Seo	5649-1121	8840
20792	7590	05/16/2005	EXAMINER	
MYERS BIGEL SIBLEY & SAJOVEC			SCHILLINGER, LAURA M	
PO BOX 37428			ART UNIT	
RALEIGH, NC 27627			PAPER NUMBER	
			2813	

DATE MAILED: 05/16/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

# Office Action Summary

Application No.

10/620,995

Applicant(s)

SEO ET AL.

Examiner

Laura M. Schillinger

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

## Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☒ Responsive to communication(s) filed on 28 February 2005.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 1-19 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-19 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

## Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some \* c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

## Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date \_\_\_\_\_
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_

## DETAILED ACTION

### *Claim Rejections - 35 USC § 102*

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 1-10, 12-19 are rejected under 35 U.S.C. 102(e) as being anticipated by Lee et al ('769).

1. A method of forming an aluminum structure in a microelectronic article, the method comprising:

forming a recess in a microelectronic substrate (Col.7, lines: 25-30);  
forming a metal-containing layer conforming to a surface of the recess and to an adjacent surface of the substrate(Col.7, lines: 45-60);  
plasma treating the substrate having the metal-containing layer thereon (Col.8, lines: 10-15); and  
depositing aluminum on the metal-containing layer to form an aluminum layer thereon (Col.8, lines: 45-55).

2. The method of Claim 1, wherein depositing aluminum comprises depositing the aluminum at a temperature of about 160 C or less (Col.11, lines: 30-50).

3. The method of Claim 1, wherein forming a recess comprises forming a contact hole in an insulating layer of the substrate that exposes an underlying conductive region of the substrate (Col.7, lines: 25-30).

4. The method of Claim 1, wherein the recess has an aspect ratio greater than about 1 (Abs., lines:1-25).

5. The method of Claim 1, wherein forming a metal-containing layer comprises forming the metal-containing layer by metal organic chemical vapor deposition (MOCVD) (Col.4, lines: 60-65).

6. The method of Claim 5, wherein the metal-containing layer is a barrier metal layer (Col.7, lines: 45-60).

7.The method of Claim 6, wherein the metal-containing layer comprises at least one material selected from a group consisting of titanium nitride (TiN), tantalum nitride (TaN), titanium silicon nitride (TiSiN) and tantalum silicon nitride (TaSiN) (Col7, lines: 45-60).

8. The method of Claim 1, wherein depositing aluminum comprises depositing aluminum on the metal-containing layer by chemical vapor deposition (CVD) using a methylpyrrolidine alane (MPA) source gas (Col.4, lines: 10-15).

9. The method of Claim 1, wherein plasma treating the substrate comprises plasma treating using at least one gas selected from a group consisting of argon (Ar), hydrogen (H<sub>2</sub>), nitrogen (N<sub>2</sub>), oxygen (O<sub>2</sub>), nitrous oxide N<sub>2</sub>O and ammonia (NH<sub>3</sub>) (Col.10, lines: 35-50).

10. The method of Claim 1, wherein plasma treating the substrate comprises plasma treating the substrate at a pressure in a range from about 1 Torr to about 6 Torr (Col.11, lines: 35-40).

12. The method of Claim 1, wherein plasma treating the substrate comprises plasma treating the substrate for about 60 seconds (Col.8, lines: 10-15).

13. The method of Claim 1: wherein forming a metal-containing layer is preceded by forming an ohmic layer conforming to an interior surface of the recess and to the adjacent surface of the insulating layer (Col.7, lines: 45-60); and wherein forming a metal-containing layer comprises forming the metal- containing layer on the ohmic layer (Col.7, lines: 45-60).

14. The method of Claim 13, wherein the ohmic layer comprises at least one of titanium (Ti) or tantalum (Ta) (Col.7, lines: 55-60)..

15. The method of Claim 1:

wherein forming a metal-containing layer comprises forming a first metal-containing layer (Col.7, lines: 45-60);

wherein plasma treating comprises plasma treating the substrate having the first metal-containing layer thereon (Col.8, lines: 10-16);

wherein depositing aluminum on the metal-containing layer comprises depositing aluminum on the first metal-containing layer to form a first aluminum layer thereon (Col.8, lines: 50-60); and

wherein the method further comprises:

forming a second metal-containing layer conforming to an interior surface of the recess and to an adjacent surface of the insulating layer (Col.7, lines 45-60);

plasma treating the substrate having the second metal-containing layer thereon (Col.10, lines: 35-50); and

depositing aluminum on the second metal-containing layer at a temperature of about 160 C or less to form a second aluminum layer thereon (Col.10, lines: 30-50).

16. The method of Claim 1, wherein depositing aluminum comprises depositing aluminum by CVD until the recess is filled (Col.4, lines :40-50).

17. The method of Claim 1, wherein depositing aluminum comprises: depositing aluminum by CVD to form a seed aluminum layer in the recess (wetting layer); and sputter depositing aluminum on the seed aluminum layer in the recess (wetting layer); and wherein the method further comprises reflowing the deposited aluminum in the recess (Col.5, lines: 45-56).

18. The method of Claim 1, wherein plasma treating the substrate comprises plasma treating the substrate under conditions sufficient to cause aluminum to deposit at a greater rate on a portion of the metal-containing layer within the recess than on a portion of the metal-containing layer adjacent the recess (Col.8, lines: 20-45).

19. The method of Claim 1, wherein the recess comprises one of a hole, a trench, a groove or a step (Col.7, lines: 25-30).

***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claim 11 is rejected under 35 U.S.C. 103(a) as being unpatentable over Lee et al ('769).

In reference to claim 11, Lee fails to explicitly teach the power level of the plasma treatment as being in a range of 600 to 1000 W.

However, the selection of the power level is obvious because it is a matter of determining optimum process condition by routine experimentation with a limited number of species. In re Jones, 162 USPQ 224 (CCPA 1955)(the selection of optimum ranges within prior art general conditions is obvious) and In re Boesch, 205 USPQ 215 (CCPA 1980)(discovery of optimum value of result effective variable in a known process is obvious).

***Response to Arguments***

Applicant's arguments filed 2/28/05 have been fully considered but they are not persuasive. Applicant argues that Lee fails to anticipate the claim language because Lee fails to teach a plasma treating step. Such an argument is not persuasive because on Col. 10, lines: 35-50, Lee teaches treating the layer to a nitrogen plasma. Applicant argues the ranges of several dependent claims stating that a plasma treatment is not taught and therefore the ranges cannot be considered obvious nor are they taught, however in light of Lee's teaching; such an argument is not persuasive. Lastly, Applicant argues that claim 18 is allowable because the plasma treatment claimed is substantially different from the sputtering technique disclosed by Lee. However, such differences are not apparent to the Examiner since sputtering uses charged particles to bombard a target and this involves ionization of atoms, hence a plasma which is an ionized gas is present during sputtering.

***Conclusion***

**THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event,

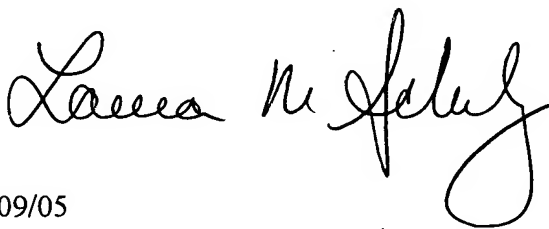
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however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Laura M. Schillinger whose telephone number is (571) 272-1697. The examiner can normally be reached on M-T, R-F 7:00-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl W. Whitehead, Jr. can be reached on (571) 272-1702. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



Laura M Schillinger  
Primary Examiner  
Art Unit 2813

05/09/05